
Name of Organization: University of MI

Type of Organization: College or University

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Project Title: Biochemical assessment of sediment quality

Project Category: Contaminated Sediments

Rank by Organization (if applicable): 0

Total Funding Requested (\$): 250,756 **Project Duration:** 2 Years

Abstract:

This proposal will develop indicators of aquatic PAH contamination that can be used to determine the integrity and health condition of aquatic environments. Specifically, this proposal is designed to: (1) develop a methodology for the isolation and structural characterization of PAH metabolites and PAH-DNA adducts in fish using liquid chromatography/electrospray ionization/mass spectrometer (LC/ESI/MS); (2) measure PAHs from sediment and fish, metabolic intermediates in fish, and biochemical endpoints (PAH-DNA adducts) in fish sampled in the Detroit, Cuyahoga, and Black Rivers (PAH contaminated) and the Portage River (control); and (3) Collect vital chemical and biochemical data on these systems and conduct multivariate statistical analysis to determine the efficacy of the technique to identify probable areas of concern and to establish whether PAHs are problematic. The benefits of the work reside in four main areas of research and protective regulations. First, this project will integrate the measurements of chemical and biochemical parameters of PAH contamination in the aquatic environment and establish linkages between sedimentary PAH(s) and quantitation of PAHs, PAH metabolites, PAH-DNA adducts in fish. Therefore, the impact of PAH contamination on aquatic ecosystem can be accurately assessed. Second, this study will provide a unique set of data and a suite of biomarkers with which the adverse effects of PAH exposure to fish and the potential biological damage to ecosystems can be studied and more meaningful assessments of the impacts of environmental contamination can be made. Third, these biomarkers can be used to screen waterways for potential PAH contamination and biological damage more effectively than by PAH surveys. Finally, This study will identify a suite of biomarkers which can be used by decision-makers as an end-point tool to measure the cleanup of PAH contamination in Areas of Concern.

Geographic Areas Affected by the Project

States:

<input type="checkbox"/> Illinois	<input type="checkbox"/> New York
<input type="checkbox"/> Indiana	<input type="checkbox"/> Pennsylvania
<input checked="" type="checkbox"/> Michigan	<input type="checkbox"/> Wisconsin
<input type="checkbox"/> Minnesota	<input checked="" type="checkbox"/> Ohio

Lakes:

<input type="checkbox"/> Superior	<input checked="" type="checkbox"/> Erie
<input checked="" type="checkbox"/> Huron	<input type="checkbox"/> Ontario
<input type="checkbox"/> Michigan	<input type="checkbox"/> All Lakes

Geographic Initiatives:

<input type="checkbox"/> Greater Chicago	<input checked="" type="checkbox"/> NE Ohio	<input type="checkbox"/> NW Indiana	<input checked="" type="checkbox"/> SE Michigan	<input type="checkbox"/> Lake St. Clair
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Primary Affected Area of Concern: Detroit River, MI

Other Affected Areas of Concern: Cuyahoga and Black Rivers, OH

For Habitat Projects Only:

Primary Affected Biodiversity Investment Area: Not Applicable

Other Affected Biodiversity Investment Areas:

Problem Statement:

Essential fish habitat in river and coastal areas has been degraded or destroyed by a number of anthropogenic factors, especially the release and transport of toxic substances. Among the more threatening compounds are polycyclic aromatic hydrocarbons (PAHs). These substances and others have led to fish consumption advisories and cancer in fishes. Typically, researchers have measured polycyclic aromatic hydrocarbons (PAH) in sediments. As sparingly soluble compounds, PAH tend to be associated with aerosol or sediment particles and may require specialized sampling and analytical techniques. Also, the total concentration measurements of PAHs do not necessarily reflect bioavailability to living organisms in the environment, nor provide evidence of the biological damage that has occurred due to the contamination. This lack of predictability of biological effects based solely on sediment chemistry data can be attributed to two major factors (Long and Chapman, 1985): (1) the chemical window we analyze and quantify is relatively narrow compared to what is likely in the sediment; and (2) the bioavailability of sediment-bound chemicals is highly variable. We need a better method of determining how prevalent these compounds are in critical fish habitat areas and how much of an impact these compounds are having on aquatic organisms.

Proposed Work Outcome:

The benefits of the work reside in four main areas of research and protective regulations. First, this project will integrate the measurements of chemical and biochemical parameters of PAH contamination in the aquatic environment and establish linkages between sedimentary PAHs and quantitation of PAH, PAH metabolites, PAH-DNA adducts in fish. Therefore, the impact of PAH contamination on aquatic ecosystem can be accurately assessed. Second, this study will provide a unique set of data and a suite of biomarkers with which the adverse effects of PAH exposure to fish and the potential biological damage to ecosystems can be studied and more meaningful assessments of the impacts of environmental contamination can be made. Third, these biomarkers can be used to screen waterways for potential PAH contamination and biological damage more effectively than by PAH surveys. Finally, the principal regulatory need is to determine the ecological effects of aquatic PAH contamination. Significant uncertainties remain in the assessment of biological damage from PAH contamination. This study will identify a suite of biomarkers which can be used by decision-makers as an end-point tool to measure the cleanup of PAH contamination in Areas of Concern.

Project Milestones:**Dates:**

QA/QC	09/2000
Field sampling	09/2000
Analytical Method Development	10/2000
Analytical Chemistry Results	11/2000
Field Sampling	10/2001
Analytical Chemistry Results	11/2001
Data Analysis/Draft Report	06/2002
Final Report	08/2002

☐ Project Addresses Environmental Justice

If So, Description of How:

☐ Project Addresses Education/Outreach

If So, Description of How:

Project Budget:**Federal Share Requested (\$)****Applicant's Share (\$)**

Personnel:	95,856	4,793
Fringe:	30,674	1,534
Travel:	7,150	358
Equipment:	0	0
Supplies:	22,550	1,128
Contracts:	0	0
Construction:	0	0
Other:	8,200	411
Total Direct Costs:	164,430	8,224
Indirect Costs:	86,326	4,316
Total:	250,756	12,540
Projected Income:	0	0

Funding by Other Organizations (Names, Amounts, Description of Commitments):

Description of Collaboration/Community Based Support:

We will collaborate with Baumann and Smith (USGS) in other PAH-related studies they are conducting on the Cuyahoga, Ashtabula (Ohio), and Detroit Rivers (MI). We will assist them in the collection of fishes and they will provide fish specimens and ancillary data on PAH concentrations in fish and sediment and provide tumor rates for the same fishes.